



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/698,878	10/31/2003	Cyprian E. Uzoh	NT-308-US	1999

20995 7590 08/02/2006

KNOBBE MARTENS OLSON & BEAR LLP  
2040 MAIN STREET  
FOURTEENTH FLOOR  
IRVINE, CA 92614

EXAMINER

VAN, LUAN V

ART UNIT PAPER NUMBER

1753

DATE MAILED: 08/02/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

**Application No.**

10/698,878

**Applicant(s)**

UZOH ET AL.

**Examiner**

Luan V. Van

**Art Unit**

1753

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 10 July 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-16 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-16 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

## **DETAILED ACTION**

### ***Continued Examination Under 37 CFR 1.114***

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on July 10, 2006 has been entered.

### ***Response to Amendment***

Applicant's amendment of July 10, 2006 does not render the application allowable.

### ***Status of Objections and Rejections***

The objection to the disclosure has been withdrawn in view of Applicant's amendment.

The objection to the claims has been withdrawn in view of Applicant's amendment.

The rejection of claims 1-13 under 35 U.S.C. 112, first paragraph, is withdrawn in view of Applicant's amendment.

The rejection of claims 3-7 under 35 U.S.C. 112, second paragraph, is withdrawn in view of Applicant's amendment.

All other rejections from the previous office action are maintained.

***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless -

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 1-2 and 8-10 are rejected under 35 U.S.C. 102(b) as being anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Dubin et al.

Regarding claims 1-2 and 9-10, Dubin et al. teach an electrodeposition process on a plurality of workpieces, each electrodeposition process comprising the steps of: determining the transition current density 706; applying an initial process current density (figure 7, feature 702) as the workpiece surface enters the process solution, wherein the initial process current density is lower than the transition current density; applying a first process current density (figure 7, feature 714) to fill the cavity (for holes having a size of 0.3-0.6  $\mu\text{m}$ ), wherein the first process current density is substantially the same as the transition current density; and applying a second process current density (figure 7, feature 722), wherein the second process current density is higher than the transition current density.

Although Dubin et al. is silent with respect to the phrasing of forming a "substantially flat profile over the opening of the cavity," Dubin et al. teach that their invention reduces "die non-uniformity, measured as a reduction of hump step height over small features" (column 6 lines 46-49). Further, "The uneven surface morphology presented by these humps leads to overpolishing in subsequent chemical mechanical polishing operation" (column 3 lines 45-47). Dubin et al. further disclose "the supefill and reverse plating steps can be repeated a number of times prior to the bulk fill operation in order to provide the desired surface morphology for chemical mechanical polishing (CMP)" (column 5 lines 35-38); and that "various combinations of forward and reverse current densities and durations may be used within the scope of the invention" (column 6 lines 59-62). Therefore, it would have been obvious to one having ordinary

skill in the art to expect that the electroplating method of Dubin et al. that reduces die non-uniformity would yield a substantially flat profile over the surface features.

Regarding claim 8, Dubin et al. teach repeating the forward current steps multiple times (column 5 lines 39-41).

Claims 3-7 and 11-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dubin et al.

Dubin et al. teach the method as described above in addressing claims 1 and 9. In addition, Dubin et al. teach "the first, second, third, fourth, and fifth forward currents are each different from the other and monotonically increasing in this illustrative embodiment. The magnitudes of the current densities of the first, second, third, and fourth currents is between 10 and 30 mA/cm<sup>2</sup> with a duration of between 2 and 60 seconds each" (column 6 lines 33-35), and this "range of current magnitudes and pulse widths provides a reduction in void formation and improved surface morphology" (column 6 lines 10-15).

The difference between the reference to Dubin et al. and the instant claims is that the reference does not explicitly teach the different sequences of various current density pulses having different durations.

However, regarding claims 3-7, Dubin et al. teach that "the magnitudes of the current densities of the first, second, third, and fourth currents is between 10 and 30 mA/cm<sup>2</sup> with a duration of between 2 and 60 seconds each" (column 6 lines 33-35); and the "forward current steps may include two or more sub-steps" (column 5 lines 39-45).

Furthermore, "various combinations of forward and reverse current densities and durations may be used within the scope of the invention" (column 6 lines 59-62).

Regarding claims 11-16, the first and second time period can be selected within the range between 2 and 60 seconds as taught by Dubin et al. such that the first time period is equal to, greater than, or less than the second time period.

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the method of Dubin et al. by optimizing various combinations of current densities and durations to produce a substantially flat surface profile, because it would reduce defects caused by overpolishing of the plated features (column 3 lines 45-49).

### ***Response to Arguments***

Applicant's arguments have been fully considered but they are not persuasive.

As a first matter, it is noted that the instant specification fails to disclose specific values or range of values for all the process current densities of the instant claims, except for the initial process current density, to patentably distinguish the instant invention from that of Dubin et al.

In the arguments presented on page 8 of the amendment, the applicant argues that Dubin et al. do not teach a single current density that would form a substantially flat profile over the cavity. The examiner acknowledges that this phrase is not explicitly stated by Dubin et al. However, Dubin et al. teach applying an initial current density of between 0.3-5 mA/cm<sup>2</sup> (column 5 lines 48-50), which is almost identical to the instant

Art Unit: 1753

invention's initial current density range of 0.5-5 mA/cm<sup>2</sup> (paragraph 48 of the instant specification). Dubin et al. also teach a superfill current density (i.e., first process current density or first transition current density) having a current density of between 10-30 mA/cm<sup>2</sup> (column 6 lines 33-35), which is higher than the initial current density. It would have been obvious, therefore, to one having ordinary skill in the art to expect the single superfill current density (figure 7, feature 714) to completely fill the features having a size of 0.3-0.6  $\mu\text{m}$  (column 5 lines 24-28) to form a substantially flat profile over these features.

The applicant further argues that Dubin et al.'s teaching that "some embodiment of the present invention is that within die non-uniformity, measured as a reduction of hump step height over small features, is reduced" suggests that Dubin et al. 's process taken as a whole achieves this result. Even assuming that this interpretation is correct, it does not teach away that the individual superfill current density by itself reduces die non-uniformity. In fact, if Dubin et al. 's process taken as a whole reduces die non-uniformity, it would have been obvious to a skilled artisan to expect that the individual superfill current density would be chosen such that it would by itself reduce die non-uniformity, because it contributes to the overall die non-uniformity. Nevertheless, as noted above, the applicant fails to disclose specific values or range of values for various current densities of the instant claims, except for the initial process current density, to patentably distinguish the instant invention from that of Dubin et al.

The die non-uniformity characteristic of Dubin et al. is broadly interpreted to have a substantially flat profile. During patent examination, the pending claims must be given



Art Unit: 1753

their broadest reasonable interpretation consistent with the specification. *In re Hyatt*, 211 F.3d 1367, 1372, 54 USPQ2d 1664, 1667 (Fed. Cir. 2000). Applicant always has the opportunity to amend the claims during prosecution, and broad interpretation by the examiner reduces the possibility that the claim, once issued, will be interpreted more broadly than is justified. *In re Prater*, 415 F.2d 1393, 1404-05, 162 USPQ 541, 550-51 (CCPA 1969). See MPEP 2111. Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

With respect to the argument that die non-uniformity is not tantamount to a substantially flat profile, the arguments of counsel cannot take the place of evidence in the record. *In re Schulze*, 346 F.2d 600, 602, 145 USPQ 716, 718 (CCPA 1965). Objective evidence which must be factually supported by an appropriate affidavit or declaration to be of probative value includes evidence of unexpected results, commercial success, solution of a long-felt need, inoperability of the prior art, invention before the date of the reference, and allegations that the author(s) of the prior art derived the disclosed subject matter from the applicant. See, for example, *In re De Blauwe*, 736 F.2d 699, 705, 222 USPQ 191, 196 (Fed. Cir. 1984). See MPEP 716.01(c).

Art Unit: 1753


***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Luan V. Van whose telephone number is 571-272-8521. The examiner can normally be reached on M-F 9:30-6:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam Nguyen can be reached on 571-272-1342. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

LWV  
July 26, 2006

  
NAM NGUYEN  
SUPERVISORY PATENT EXAMINER  
TECHNOLOGY CENTER 1700